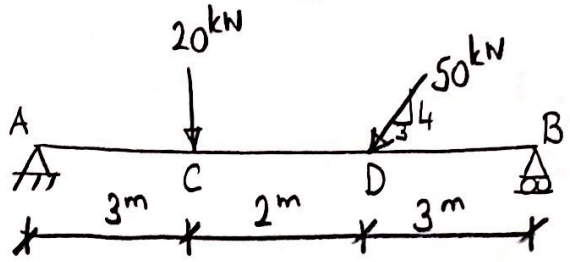
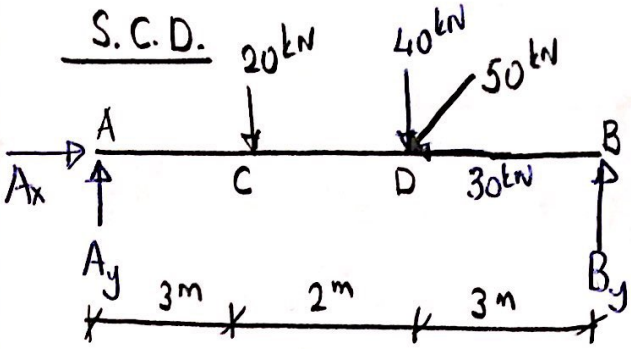
① 

Açıklık ve yüklenme durumu şekilde verilen kirişin normal kuvvet (N), kesme kuvveti (T) ve eğilme moment diyagramlarını çiziniz.

S.C.D. 

$\overset{+}{\circlearrowleft}\Sigma M_A = 0 \Rightarrow B_y \cdot 8 - 20 \cdot 3 - 40 \cdot 5 = 0$

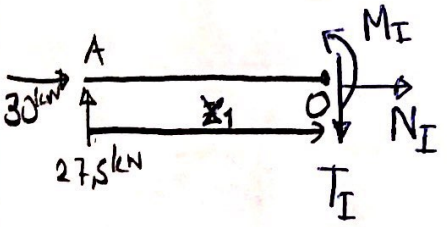
$B_y = 32,5^{kN} (\uparrow)$

$\overset{+}{\rightarrow}\Sigma F_x = 0 \Rightarrow A_x - 30 = 0 \Rightarrow A_x = 30^{kN} (\rightarrow)$

$\uparrow \Sigma F_y = 0 \Rightarrow A_y + 32,5 - 20 - 40 = 0$

$A_y = 27,5^{kN} (\uparrow)$

AC Bölgesi ($0 \leq x_1 \leq 3^m$)

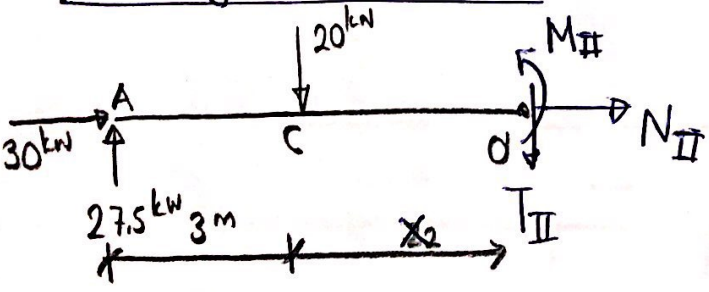


$\overset{+}{\circlearrowleft}\Sigma M_0 = 0 \Rightarrow M_I - 27,5 \cdot x_1 = 0 \Rightarrow M_I = 27,5 x_1$

$\overset{+}{\rightarrow}\Sigma F_x = 0 \Rightarrow N_I + 30 = 0 \Rightarrow N_I = -30^{kN}$

$+\uparrow \Sigma F_y = 0 \Rightarrow 27,5 - T_I = 0 \Rightarrow T_I = 27,5^{kN}$

CD Bölgesi ($0 \leq x_2 \leq 2^m$)



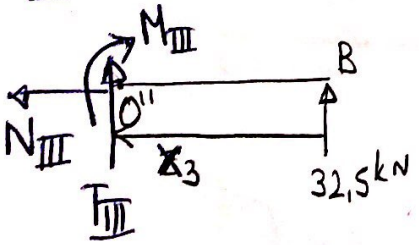
$\overset{+}{\circlearrowleft}\Sigma M_0' = 0 \Rightarrow M_{II} + 20 \cdot x_2 - 27,5(3 + x_2) = 0$

$M_{II} = (82,5 + 7,5 x_2)$

$\overset{+}{\rightarrow}\Sigma F_x = 0 \Rightarrow N_{II} + 30 = 0 \Rightarrow N_{II} = -30^{kN}$

$\uparrow \Sigma F_y = 0 \Rightarrow 27,5 - T_{II} - 20 = 0 \Rightarrow T_{II} = 7,5^{kN}$

a) BD Bölgesi ($0 \leq x_3 \leq 3^m$) .. (Sağ taraftan kesim yapılırsa)



$\overset{+}{\circlearrowleft}\Sigma M_{0''} = 0 \Rightarrow M_{III} - 32,5 x_3 = 0 \Rightarrow M_{III} = 32,5 x_3$

$\uparrow \Sigma F_y = 0 \Rightarrow T_{III} + 32,5 = 0 \Rightarrow T_{III} = -32,5^{kN}$

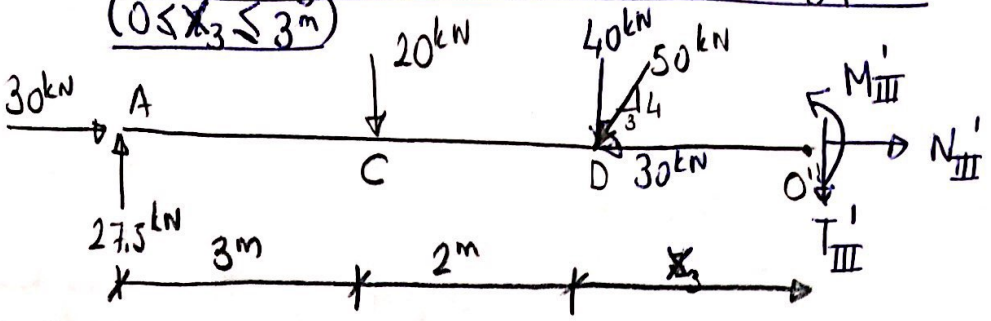
$\overset{+}{\rightarrow}\Sigma F_x = 0 \Rightarrow -N_{III} = 0 \Rightarrow N_{III} = 0$

b) DB Bölgesi

Sol taraftan kesim $\rightarrow$

b) DB Bölgesi (Sol taraftan kesim yapılırsa)

$(0 \le x_3 \le 3^m)$

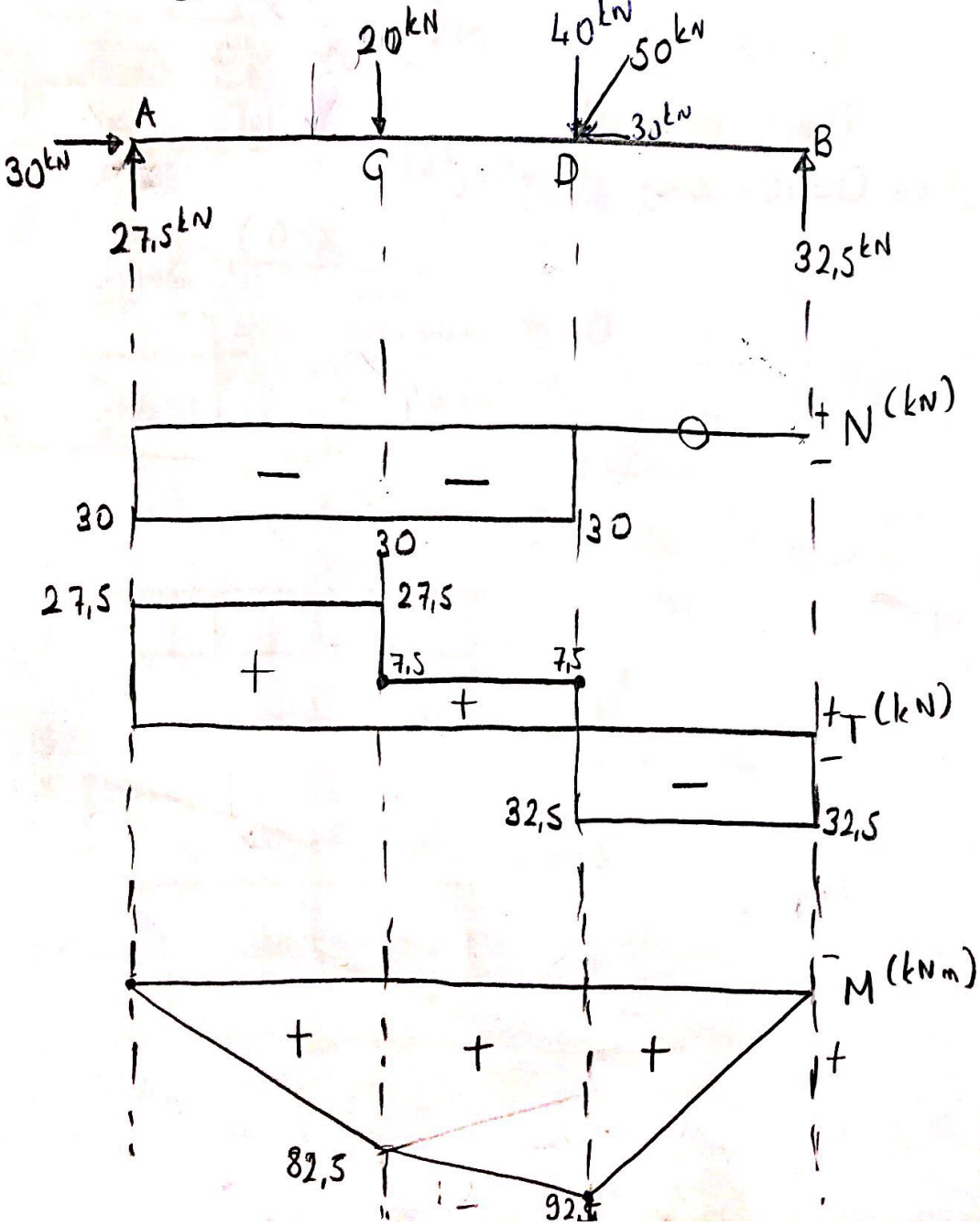


$\overset{+}{\circlearrowleft} \Sigma M_{O'} = 0 \Rightarrow M'_{III} + 20.(x_3+2) + 40.x_3 - 27,5.(5+x_3) = 0$

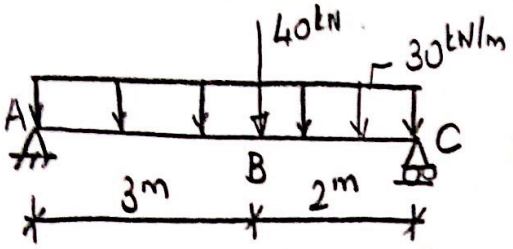
$M'_{III} = 97,5 + 32,5x_3$

$+\downarrow \Sigma F_y = 0 \Rightarrow T'_{III} + 40 + 20 - 27,5 = 0 \Rightarrow T'_{III} = -32,5^{kN}$

$\overset{+}{\rightarrow} \Sigma F_x = 0 \Rightarrow N'_{III} - 30 + 30 = 0 \Rightarrow N'_{III} = 0$

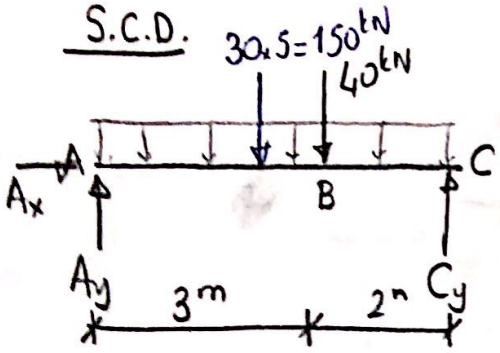


(2)



Şekilde verilen kiriş kesme kuvveti (T) ve eğilme momenti (M) diyagramlarını çiziniz.

S.C.D.



$\overrightarrow{+}\sum F_x = 0 \Rightarrow A_x = 0$

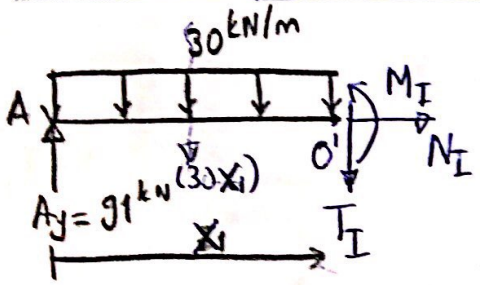
$\curvearrowleft \sum M_A = 0 \Rightarrow C_y \cdot 5 - 40 \cdot 3 - 150 \cdot 2{,}5 = 0$

$C_y = 99\,kN\ (\uparrow)$

$+\uparrow \sum F_y = 0 \Rightarrow A_y + 99 - 150 - 40 = 0$

$A_y = 91\,kN\ (\uparrow)$

A-B Bölgesi ($0 \le x_1 \le 3m$):



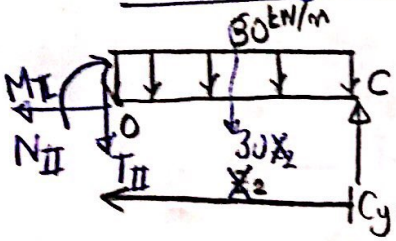
$\overrightarrow{\sum} F_x = 0 \Rightarrow N_I = 0$

$\curvearrowleft \sum M_{O'} = 0 \Rightarrow M_I - 91 \cdot x_1 + 30 \cdot x_1 \cdot (0{,}5 x_1) = 0$

$M_I = (91 x_1 - 15 x_1^2)$

$+\downarrow \sum F_y = 0 \Rightarrow T_I + 30 x_1 - 91 = 0 \Rightarrow T_I = (91 - 30 x_1)$

C-B Bölgesi ($0 \le x_2 \le 2m$):

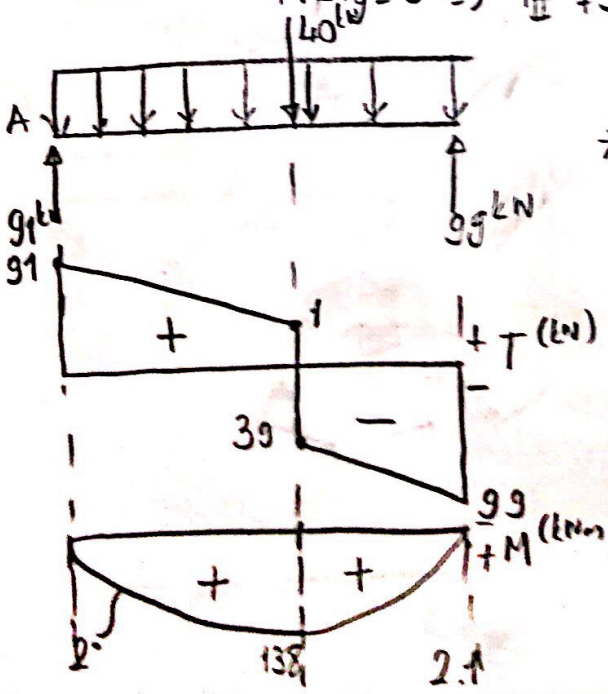


$\overrightarrow{+} \sum F_x = 0 \Rightarrow N_{II} = 0$

$\curvearrowleft \sum M_{O'} = 0 \Rightarrow M_{II} + 30 x_2 \cdot (0{,}5 x_2) - 99 \cdot x_2 = 0$

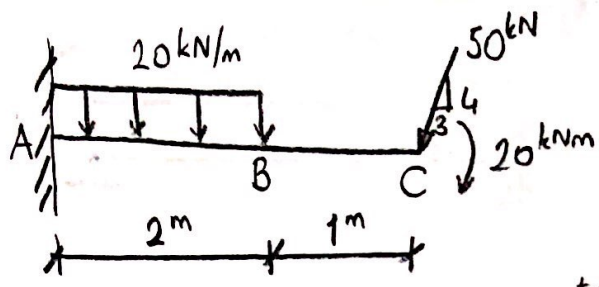
$M_{II} = (99 x_2 - 15 x_2^2)$

$+\uparrow \sum F_y = 0 \Rightarrow T_{II} + 30 x_2 - 99 = 0 \Rightarrow T_{II} = (99 - 30 x_2)$

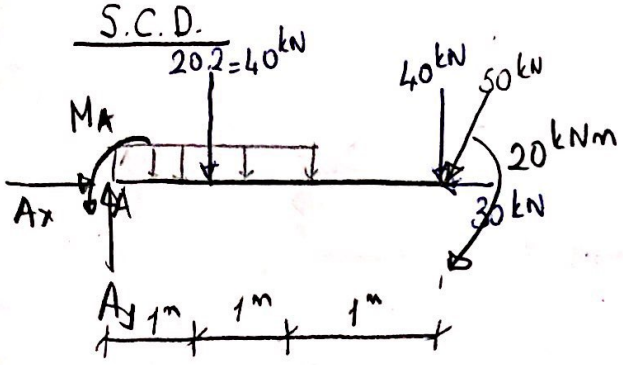


* Kesme kuvvetinin sıfır olduğu noktada eğilme momenti max. değerini alır.

3 Şekilde yükleme durumu verilen kirişin N, M, T diyagramlarını çiziniz.



S.C.D.

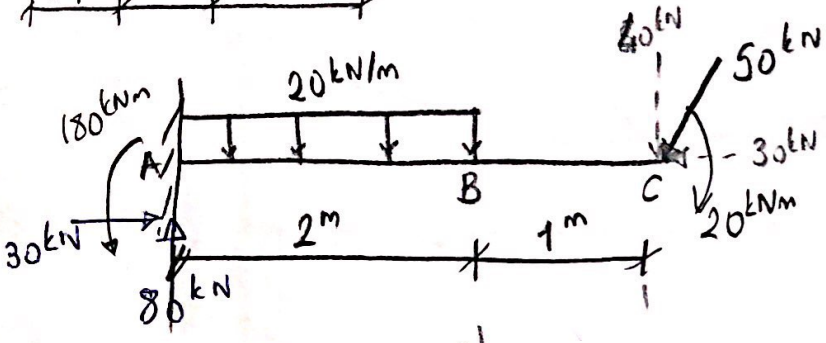


$+\circlearrowleft \sum M_A = 0 \Rightarrow M_A - 40.1 - 40.3 - 20 = 0$

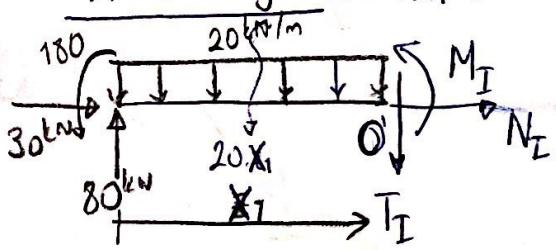
$M_A = 180^{kNm}\ (\circlearrowleft)$

$\overrightarrow{+} \sum F_x = 0 \Rightarrow A_x - 30 = 0 \Rightarrow A_x = 30^{kN}\ (\rightarrow)$

$+\uparrow \sum F_y = 0 \Rightarrow A_y - 40 - 40 = 0 \Rightarrow A_y = 80^{kN}\ (\uparrow)$



A-B Bölgesi $(0 \le x_1 \le 2m)$



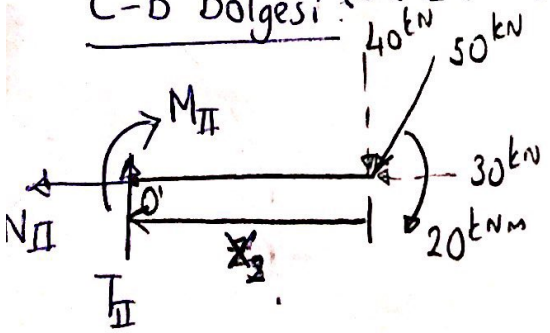
$\overrightarrow{+} \sum F_x = 0 \Rightarrow N_I + 30 = 0 \; ; \; N_I = -30^{kN}$

$+\circlearrowleft \sum M_0 = 0 \Rightarrow M_I + 20x_1 \cdot 0{,}5x_1 - 80 \cdot x_1 + 180 = 0$

$M_I = -10x_1^2 + 80x_1 - 180$

$+\downarrow \sum F_y = 0 \Rightarrow T_I + 20x_1 - 80 = 0 \Rightarrow T_I = 80 - 20x_1$

C-B Bölgesi $(0 \le x_2 \le 1m)$

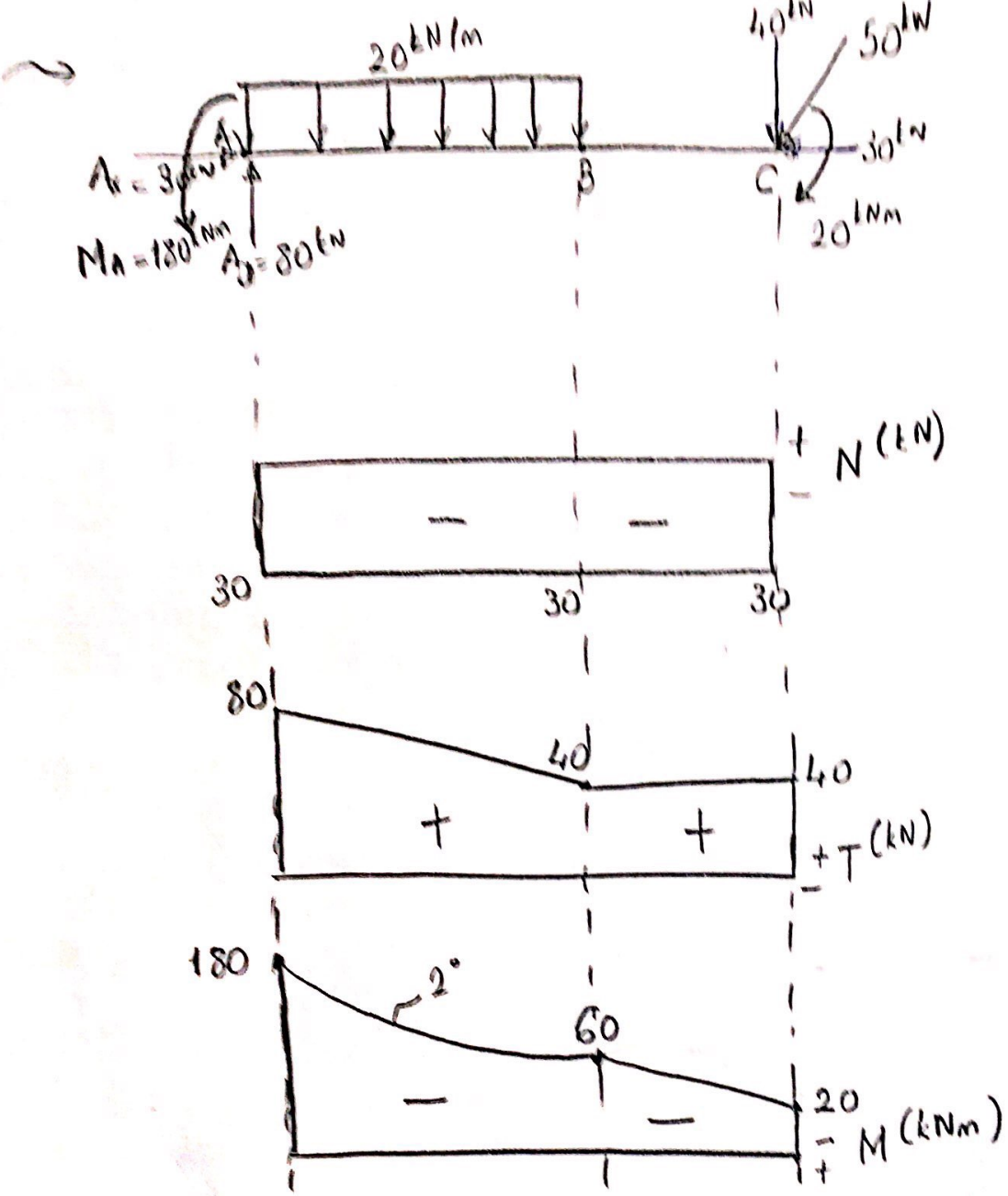


$\overrightarrow{+} \sum F_x = 0 \Rightarrow -N_{II} - 30 = 0 \Rightarrow N_{II} = -30^{kN}$

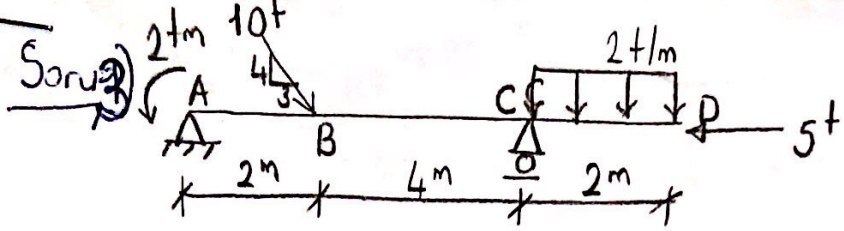
$\circlearrowright^{+} \sum M_{O'} = 0 \Rightarrow M_{II} + 40 \cdot x_2 + 20 = 0 = 0$

$M_{II} = -20 - 40x_2$

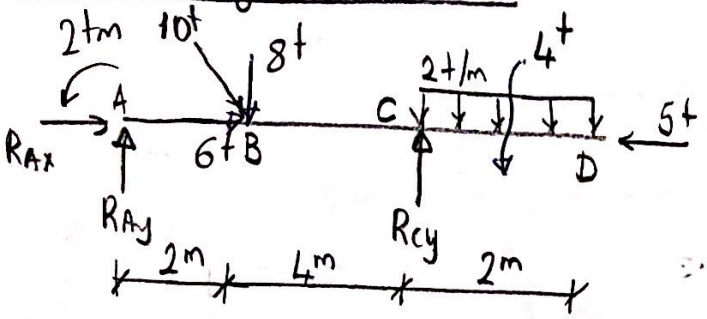
$\uparrow \sum F_y = 0 \Rightarrow T_{II} - 40 = 0 \Rightarrow T_{II} = 40^{kN}$



Soru 3) Şekilde verilen kirişin normal kuvvet(N), kesme kuvveti(V) ve eğilme momenti(M) diyagramlarını çizmiz.



* Mesnet reaksiyonları belirlenir:



$\curvearrowleft \Sigma M_A = 0$

$\Rightarrow R_{cy}.6 - 8.2 - 4.7 + 2 = 0$

$R_{cy} = 7^t (\uparrow)$

$\uparrow \Sigma F_y = 0 \Rightarrow R_{Ay} + R_{cy} - 8 - 4 = 0$

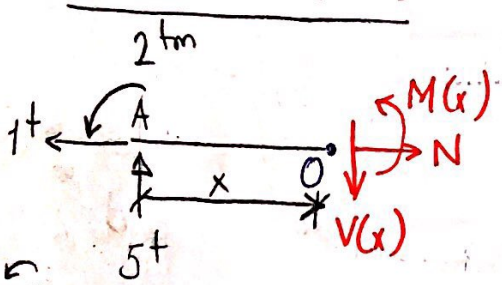
$R_{Ay} + 7 - 8 - 4 = 0$

$R_{Ay} = 5^t (\uparrow)$

$\rightarrow \Sigma F_x = 0 \Rightarrow R_{Ax} - 5 + 6 = 0 \Rightarrow R_{Ax} = -1^t$

$R_{Ax} = 1^t (\leftarrow)$

A-B $(0 \leq x \leq 2m)$



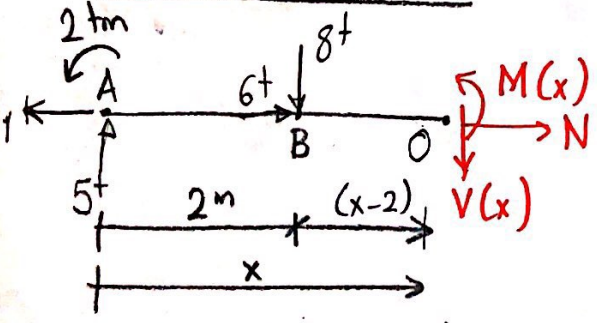
$\curvearrowleft \Sigma M_0 = 0 \Rightarrow M(x) + 2 - 5x = 0$

$M(x) = (5x - 2)$

$\downarrow \Sigma F_y = 0 \Rightarrow V(x) - 5 = 0 \Rightarrow V(x) = 5^t$

$\rightarrow \Sigma F_x = 0 \Rightarrow N - 1 = 0 \Rightarrow N = 1^t$

B-C $(2m \leq x \leq 6m)$



$\curvearrowleft \Sigma M_0 = 0 \Rightarrow M(x) + 2 + 8(x-2) - 5x = 0$

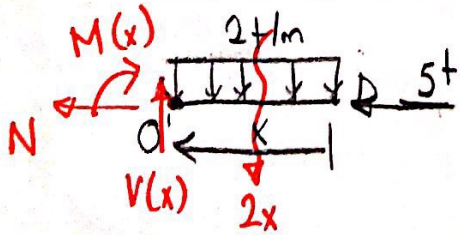
$M(x) = (14 - 3x)$

$\downarrow \Sigma F_y = 0 \Rightarrow V(x) + 8 - 5 = 0$

$V(x) = -3^t$

$\rightarrow \Sigma F_x = 0 \Rightarrow N - 1 + 6 = 0 \Rightarrow N = -5^t$

D-C $(0 \leq x \leq 2m)$



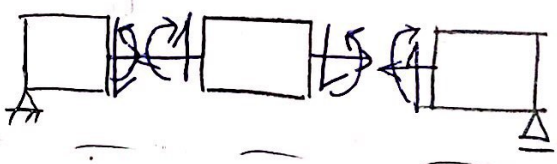
$\curvearrowright \Sigma M_{0'} = 0 \Rightarrow M(x) + 2x \cdot \frac{x}{2} = 0$

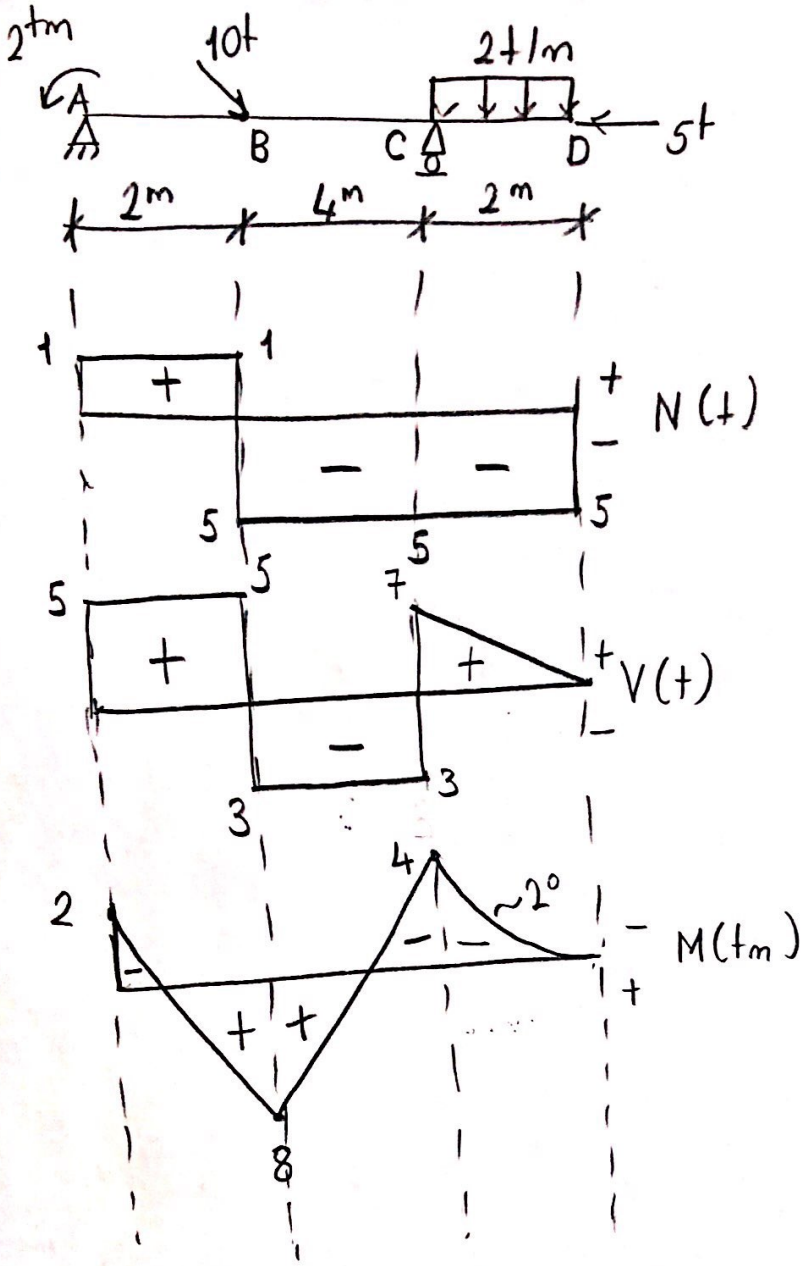
$M(x) = -x^2$

$\uparrow \Sigma F_y = 0 \Rightarrow V(x) - 2x = 0 \Rightarrow V(x) = 2x$

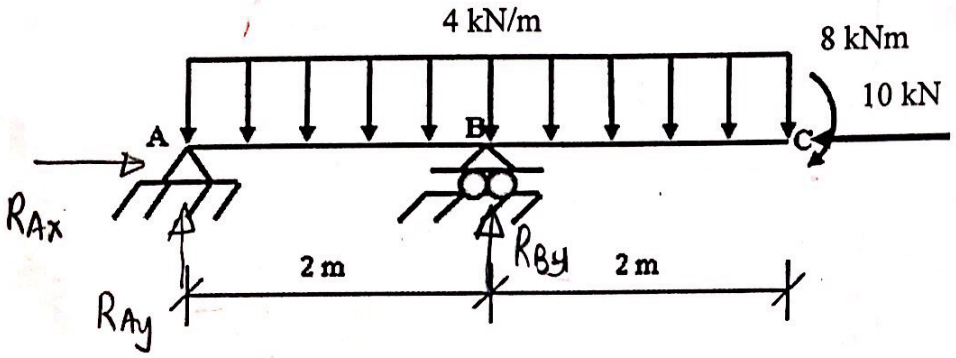
$\rightarrow \Sigma F_x = 0 \Rightarrow N + 5 = 0 \Rightarrow N = -5^t$

İşaret Kuralı





Şekildeki sistemin normal kuvvet (N), eğilme momenti(M) ve kesme kuvveti (T) diyagramlarını çiziniz. Başarılar.

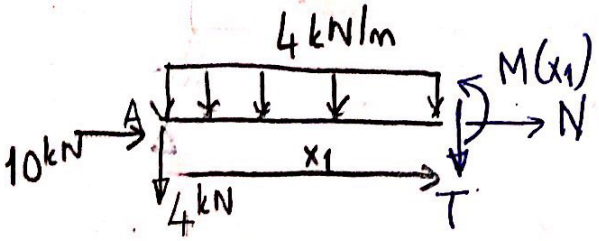


$\curvearrowleft \Sigma M_A = 0 \Rightarrow R_{By} \cdot 2 - 4 \cdot 4 \cdot 2 - 8 = 0 \Rightarrow R_{By} = 20^{kN}(\uparrow)$ (5)

$\uparrow \Sigma F_y = 0 \Rightarrow R_{Ay} + 20 - 4 \cdot 4 = 0 \Rightarrow R_{Ay} = 4^{kN}(\downarrow)$ (5)

$\vec{\Sigma} F_x = 0 \Rightarrow R_{Ax} - 10 = 0 \Rightarrow R_{Ax} = 10^{kN}(\rightarrow)$ (5)

A-B $(0 \leq x_1 \leq 2^m)$



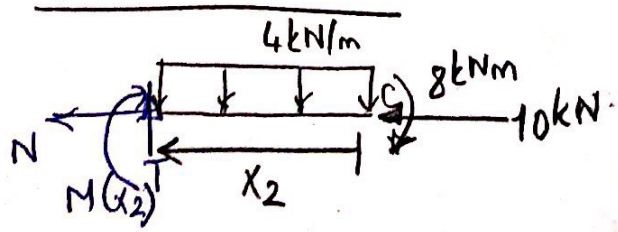
$M(x_1) + 4x_1 + 4x_1 \cdot \frac{x_1}{2} = 0$

$M(x_1) = -(4x_1 + 2x_1^2)$ (5)

$T + 4 + 4x_1 = 0 \Rightarrow T = -(4 + 4x_1)$ (5)

$N + 10 = 0 \Rightarrow N = -10^{kN}$ (5)

C-B $(0 \leq x_2 \leq 2^m)$

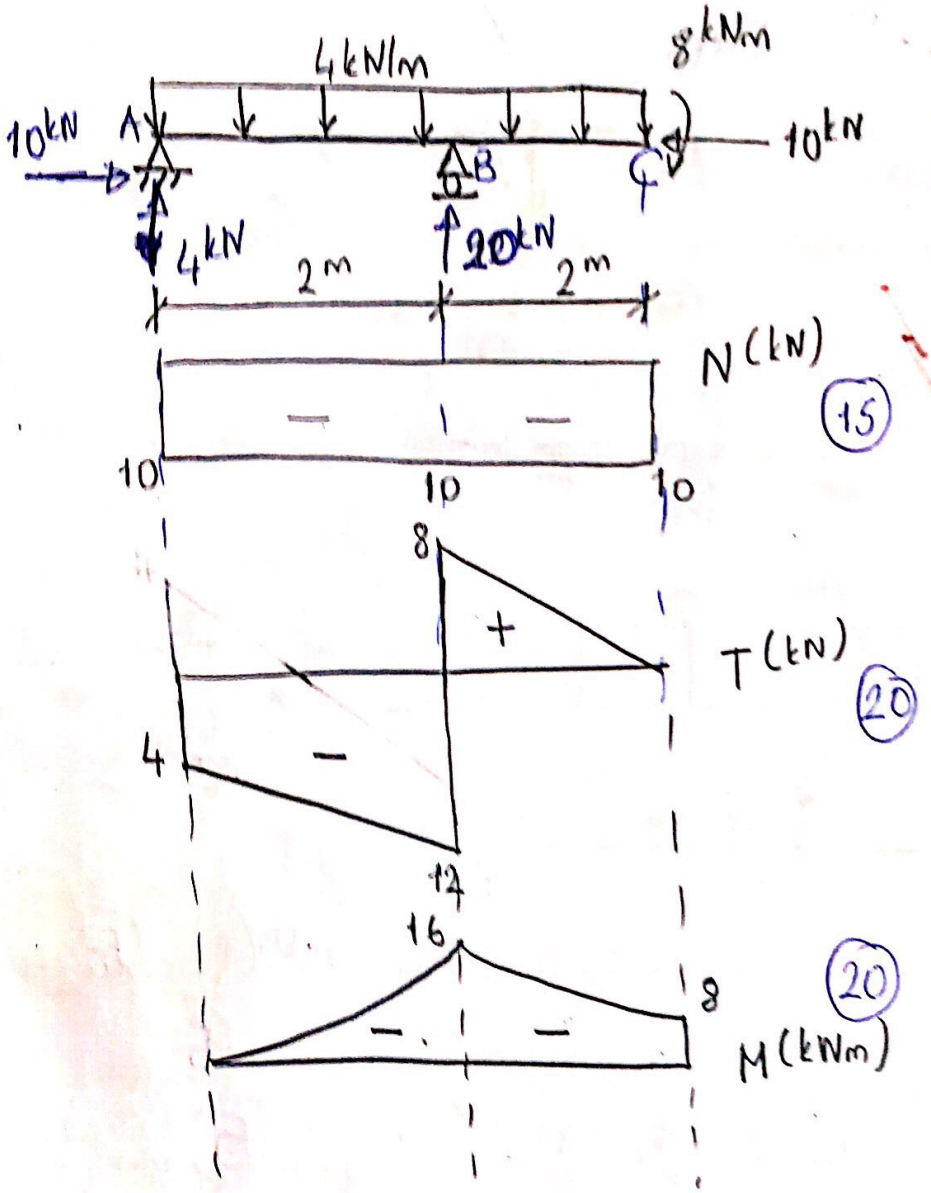


$M(x_2) + 4x_2 \cdot \frac{x_2}{2} + 8 = 0$ (5)

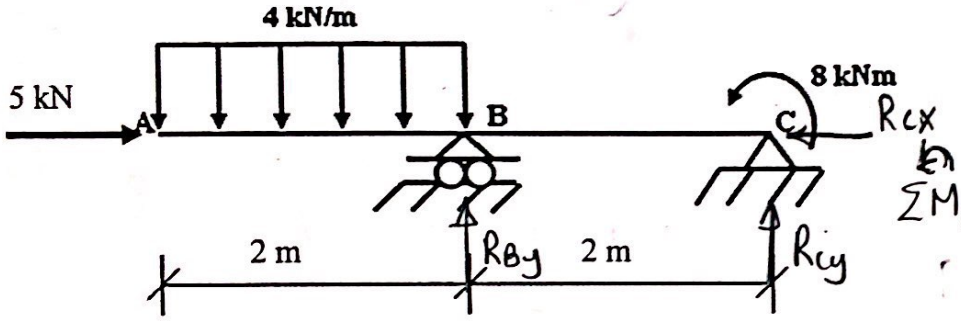
$M(x_2) = -(2x_2^2 + 8)$

$T - 4x_2 = 0 \Rightarrow T = 4x_2$ (5)

$N + 10 = 0 \Rightarrow N = -10$ (5)



Şekildeki sistemin normal kuvvet (N), eğilme momenti(M) ve kesme kuvveti (T) diyagramlarını çiziniz. Başarılar.



$\curvearrowleft \Sigma M_B = 0 \Rightarrow R_{cy} \cdot 2 + 8 + 4 \cdot 2 \cdot 1 = 0$

$R_{cy} = -8^{kN}$

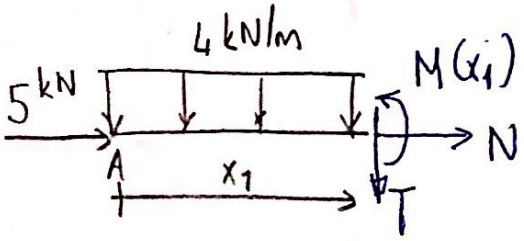
$R_{cy} = 8^{kN}\ (\downarrow)$ (5)

$\uparrow \Sigma F_y = 0 \Rightarrow R_{By} - 8 - 4 \cdot 2 = 0$

$R_{By} = 16^{kN}\ (\uparrow)$ (5)

$\leftarrow \Sigma F_x = 0 \Rightarrow R_{cx} = 5^{kN}\ (\leftarrow)$ (5)

A-B $(0 \leq x_1 \leq 2^m)$



$M(x_1) + 4x_1 \cdot \frac{x_1}{2} = 0$

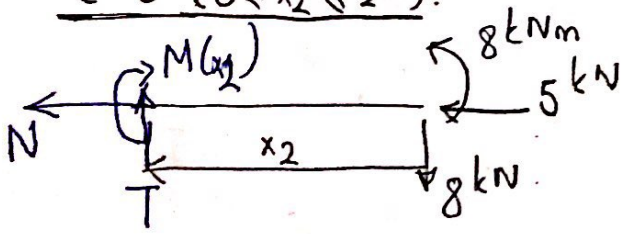
$M(x_1) = -2x_1^2$ (5)

$T + 4x_1 = 0$ (5)

$T = -4x_1$

$N + 5 = 0 \Rightarrow N = -5$ (5)

C-B $(0 \leq x_2 \leq 2m)$:



$M(x_2) + 8x_2 - 8 = 0$

$M(x_2) = (8 - 8x_2)$ (5)

$T - 8 = 0 \Rightarrow T = 8^{kN}$ (5)

$N + 5 = 0 \Rightarrow N = -5^{kN}$ (5)